

Space Technology

Game Changing Development

ISAAC: An Integrated System for Autonomous and Adaptive Caretaking

NASA needs autonomous systems to help monitor and maintain exploration spacecraft and habitats during long-duration, deep-space missions.

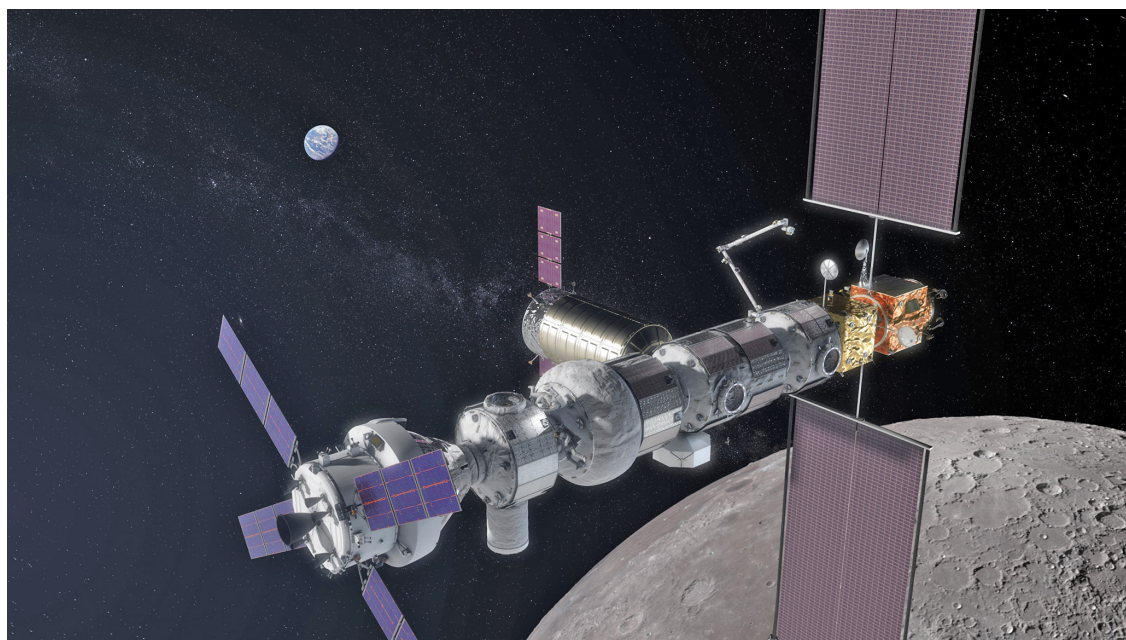
To satisfy this need, the Integrated System for Autonomous and Adaptive Caretaking (ISAAC) project will develop key technologies required for autonomous and adaptive caretaking. The ISAAC project will build upon prior NASA advances in autonomy, avionics, logistics, robotics, and ground testing infrastructure. The ISAAC project has three primary development objectives.

The first objective for the ISAAC project is to create technology for autonomous state

assessment of spacecraft interior environments during uncrewed periods. To do this, the project will unify spacecraft data and models with autonomous robotics, linking data from spacecraft subsystems, sensor networks, and robots with 3D geometry and maps. Simulation will be used to integrate models of selected spacecraft subsystems and of autonomous robots (mobile inspector and mobile manipulator). This will enable the development of multi-modal mapping techniques.

The second objective for the ISAAC project is to create technology for autonomous logistics management for spacecraft during uncrewed periods. The project will develop

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Artist conception of the Gateway orbiting the Moon.

autonomous logistics management tools that integrate data and that provide increased situation awareness in support of the Human Exploration and Operations Mission Directorate's (HEOMD) Advanced Exploration Systems (AES) Logistics Reduction (LR) project. In particular, the ISAAC project will develop an integrated control interface that combines interface tools for spacecraft subsystems and autonomous robots in order to improve situation awareness and robot operator productivity,

The third objective of the ISAAC project is to create technology for integrated fault management of spacecraft during uncrewed periods. The focus of this work will be to develop a data framework for coordinated execution based on distributed data collection and analysis. This framework will reduce the time to effect changes on spacecraft systems during critical faults and emergencies. Changes will be accomplished by developing distributed fault management strategies and by developing algorithms to identify and request data needed for fault diagnosis.

The ISAAC project will coordinate technology development and demonstration with the Space Technology Mission Directorate's Smart Deep Space Habitats (SmartHabs) Institute, the HEOMD AES Autonomous

Systems and Operations (ASO) and the HEOMD AES LR projects. ISAAC may serve as an infusion point for new basic technologies developed by the SmartHabs Institute, such as novel analytical methods for complex, highly interdependent habitat systems. The ISAAC Project may also perform joint testing and demonstrations with the ASO and LR projects using ground analogs or the International Space Station.

The ISAAC project will closely track the concept of operations, requirements, and standards being developed by the HEOMD Intravehicular Robotics working group. This working group supports the design of the Gateway, which is a proposed deep space outpost that would orbit the moon. ISAAC will also focus technology development to address key technical gaps identified for future human spacecraft, with emphasis on Gateway.

The Game Changing Development (GCD) Program is part of NASA's Space Technology Mission Directorate. The GCD Program aims to advance exploratory concepts and deliver technology solutions that enable new capabilities or radically alter current approaches.

For more information about GCD, please visit <http://gameon.nasa.gov/>

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